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THE SCIENCE CURRICULUM IN JUNIOR COLLEGES

Thesis

Submitted by

Colin Bentley

(B.S. Harvard University, 1948)

In partial fulfillment of requirements
for the degree of Master of Education

1949

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CHAPTER I

STATEMENT OF THE PROBLEM

Purpose

Today science is one of the most important bases upon which our society is built. Innumerable happenings in our civilization are caused by or related to some phase of science. Science has attained a place of importance in our culture of today that far exceeds its place in previous societies. But has science education kept pace with this tremendous advance of science to this place of importance? This study will attempt to discover just what science courses are being offered in one special area of education, namely the advanced secondary school or grades thirteen and fourteen. It will also present the reasons as to why such courses are being offered in order to answer this question. The study will also be further limited to a study of the junior college which consists of grades thirteen and fourteen only.

The junior college is now recognized as being part of the secondary school. This study, therefore, is concerned with the problem of discovering the current curriculum practices in science in the junior college with the idea of presenting the trends, if any, being followed in this type of school which seem to be a result of the increased emphasis on science in our modern society.

The importance of the junior college movement in the United States as well as the importance of science education in all schools

cannot be overlooked. This work will attempt to consider both of these phases of education simultaneously by presenting a study of science in the junior college. With many educators advocating that grades thirteen and fourteen should be made a part of the public school system, the importance of having a well-balanced, functional science curriculum in these grades is increased many-fold. This study will show how well constructed the science curriculum in these grades is and it will also judicate how valuable these courses are to students who chose to matriculate in schools on the junior college level whether they be students who wish to make science or any other branch of learning the basis for their life work.

Scope

This study is limited to a survey of the junior colleges of New England. It is also limited to a study of only those colleges which offer at least one course in science. As over ninety per cent of the junior colleges do offer some science course this later limitation affects this study only slightly. The colleges surveyed include private and public schools existing as coeducational colleges or colleges restricted to either men or women. The exact nature of the schools surveyed is presented in the appendix of this work.

Procedures

Two distinct methods have been followed in gathering the material presented in this study. First, compilations of books and

periodicals were studied and all material pertinent to the science curriculum was obtained, if available. This material is presented in tabular form with a discussion of each table in the next chapter which deals with related research. Considerable work has been done on the subject of the total curriculum of the junior college, but little has been done considering or emphasizing the courses offered in science in these schools. Because there is much information lacking in literature concerning the science courses offered, the author of this present study constructed a questionnaire designed to gain information not obtainable through a study of literature dealing with the junior college.

No one previous work studied was devoted entirely to the science curriculum nor did any emphasize these courses to any considerable extent. Therefore, little information necessary for this study could be obtained from a survey of literature. The author's questionnaire was designed to obtain this information. As a result, the major part of this thesis presents and discusses the findings as reported from a compilation of the data collected by this questionnaire.

The questionnaire consisted of two parts. The first part was designed to record the exact science courses being offered as well as the enrollment in each course, the number of semester hours credit each course is given, and also whether or not there is a laboratory offered in conjunction with each course. All this data is factual material. The second part of the questionnaire was con-

structed to discover the place of science in the total curriculum of the college and also to see what new trends in science teaching were being followed or introduced. This part of the questionnaire also was designed to gather mostly factual material as the author wished to have as little personal opinion as possible forming a basis for this study.

The questionnaire was sent out to thirty junior colleges in New England. Twenty-three questionnaires were returned, a return of seventy-seven per cent. All types of junior colleges were represented randomly thus not necessitating further breakdowns in the consideration of the data obtained. The questionnaire and covering letter are presented at the end of this present chapter.

The material gathered by the questionnaire is presented in Chapter III. Each major branch of science is discussed individually. That is, the courses offered in one branch of science with other information pertinent to that branch only are presented. Then the purpose of the total science curriculum is considered. In this manner the purpose of teaching science in the junior college will be brought out along with the value of the science curriculum or any part of it. The value to both science and non-science majors is discussed. This thesis, thus, is not intended solely for use by students who wish majors in science only. The value of science to the non-science majors is presented as the author feels this aspect of the science curriculum is neglected to far too great an extent.

The last chapter of this study is devoted to a summary of the findings and a presentation of the conclusions to be drawn from these findings. The implications of these conclusions are discussed along with recommendations for further research.

8 Forest Street
Manchester, Mass.
December 31, 1948

Director of Science Department
College
Address

Dear Sir:

I am doing graduate work at Boston University and I am writing a thesis under the direction of Professor John Read around the problem of the content and purpose of the science curriculum in Junior Colleges.

I have prepared the enclosed questionnaire to gather information regarding this problem. I would be grateful if you would fill out the questionnaire and send it back to me in the envelope provided as soon as possible.

Thank you for your kind consideration of this matter and for your help in effecting a solution to this problem.

Very truly yours,

Colin Bentley

THE SCIENCE CURRICULUM IN JUNIOR COLLEGES

The results of this questionnaire are going to be used in helping me to construct my thesis and are also going to be distributed to high school teachers to whom they should prove very valuable.

I. Please check the courses offered in your college and fill in the blanks with the correct information.

Course	Approximate Enrollment	Semester Hours Credit	Is a Laboratory Offered?
Chemistry			
__General	_____	_____	Yes__ No__
__Organic	_____	_____	Yes__ No__
__Inorganic	_____	_____	Yes__ No__
__Quantitative Analysis	_____	_____	Yes__ No__
__Qualitative Analysis	_____	_____	Yes__ No__
__Others (List)	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
Physics			
__General	_____	_____	Yes__ No__
__Mechanics	_____	_____	Yes__ No__
__Optics	_____	_____	Yes__ No__
__Thermodynamics	_____	_____	Yes__ No__
__Electricity	_____	_____	Yes__ No__
__Atomic	_____	_____	Yes__ No__
__Others (List)	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
Biology			
__Botany	_____	_____	Yes__ No__
__Anatomy	_____	_____	Yes__ No__
__Zoology	_____	_____	Yes__ No__
__Others (List)	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__

Course	Approximate Enrollment	Semester Hours Credit	Is a Laboratory Offered?
Astronomy			
__General	_____	_____	Yes__ No__
__Others (List)	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
__ _____	_____	_____	Yes__ No__
Physical Sciences			
__	_____	_____	Yes__ No__

II.

1. Do your college course requirements include a science course?
   Yes__ No__
2. What science courses have been added since the war?

   _____ _____ _____ _____
3. How long has the science program been in effect in your Junior College? Since its founding_____ Since_____(year)
4. What courses are integrated in your physical science course if one is offered?
   __Chemistry
   __Physics
   __Biology
   __Astronomy
   __Others (List)
   __ _____
   __ _____
   __ _____
5. What is the maximum number of science courses a student can take in your college?
   Number of courses_____ or Number of semester hours_____
6. Can students major in a science program at your college?
   Yes__ No__
7. Are your science courses:
   __Vocational
   __Preparatory
   __Terminal

8. Do you have separate laboratories for each of the following sciences?

Chemistry	Yes__ No__
Physics	Yes__ No__
Biology	Yes__ No__
Astronomy	Yes__ No__

Or do you have laboratories for the following combinations? Please check.

__chemistry-physics
__chemistry-biology
__biology-physics
__chemistry-physics-biology
__chemistry-physical sciences
__physics-physical sciences
__biology-physical sciences
__one laboratory for all sciences
__Please list any other combination
__ _____
__ _____
__ _____
__ _____

CHAPTER II

RELATED RESEARCH

In the previous chapter the problem of this thesis was presented as were the methods of gathering information necessary for the solving of the problem. Before presenting the data obtained, previous research relevant to the problem should be discussed. That is the purpose of this chapter.

Voluminous writings have appeared concerning the junior college and the various curricula found in this type of school. Some of this material has concerned the science curriculum although few studies have broken down curricula studies into specific fields as this study will do. In order to better understand the purpose of this work some of these studies will now be discussed and related to this one.

Koos[1] made a study of the junior college science curriculum in 1924 when the movement was not as widespread as it is now. He surveyed both public and private junior colleges reporting the science courses then being taught. His findings are presented in the following table.

1/ Leonard V. Koos. The Junior College, University of Minnesota, Minneapolis, Minn., 1924.

TABLE 1

Science Offerings in Fifty-Eight Junior Colleges*

Course	Number of Schools Offering the Course	Per Cent of Total
Biology		
Botany	33	57
Zoology	30	52
Bacteriology	10	17
Physiology	10	17
General	9	16
Genetics	6	10
Hygiene	3	5
Chemistry		
General	42	72
Organic	19	33
Qualitative	19	33
Quantitative	12	21
Physics		
General	25	43
Mechanics	5	9
Electricity	3	5

*Adapted from The Junior College, Leonard V. Koos.

From the table it can readily be seen that general courses are by far the most popular offerings. The other more specific courses are offered far less frequently. All courses were offered in both private and public junior colleges with neither type school having any important predominance in the offerings in any one field of science although predominance in offering specific courses occurred but in a very random fashion so that one type school was represented as offering a specific course more often and another type school offering different courses more frequently.

Although Koos recommended that science courses should constitute twenty-five per cent of the total curriculum in a liberal

arts college his study showed they actually constituted only fourteen per cent. His study also showed that no physics courses were prescribed. Seventy-two per cent of the schools surveyed prescribed general chemistry while approximately fifteen per cent prescribed a biology course. No figures were presented to tell how many schools prescribed a science course as part of their college curriculum requirements.

In 1929, Whitney[1] conducted a study similar to Koos', but he included the average number of semester hours credit each course received. Since sixty to sixty-four semester hours credit were required for graduation then and are still today, these figures can be compared to those obtained in this present study. Whitney's work is also presented in tabular form as was the preceding work.

1/ Frederick L. Whitney. The Junior College in America, Colorado State Teachers College, Greeley, Colorado, 1929.

TABLE 2

A Survey of Science Offerings in Thirty Junior Colleges*

Course	Number of Colleges Offering the Course	Per Cent Offering	Semester Hours Credit
Biology			
Botany	16	53	5.3
General	13	43	4.2
Zoology	11	37	3.5
Physiology	7	23	3
Bacteriology	4	13	3.5
Chemistry			
Inorganic	17	57	5.6
Qualitative	13	43	5.4
Organic	9	30	6.2
Quantitative	8	27	3.7
General	8	27	7.6
Physics			
General	10	32	5
Electricity	7	23	7.6
Mechanics	6	20	4.1

*Adapted from The Junior College in America, Frederick L. Whitney.

Whitney found the science offerings to constitute twelve per cent of the total curriculum, a figure slightly lower than the one established by Koos. The position of each course, when arranged according to highest per cent of the total offering, varies no more than one position in both studies if we assume inorganic chemistry and general chemistry to be similar in nature of material presented.

In this same year, Gray's[1] study found that fifty-eight per cent of the junior colleges he surveyed required a science course. So in four years the trend seemed to be towards fewer schools requiring science as part of their program. Gray also found

1/ William S. Gray. The Junior College Curriculum, University of Chicago Press, Chicago, Illinois, 1929, 261 pp.

twelve per cent and seven per cent, respectively, of these schools offered physical science and biological science survey courses. These figures will later be correlated to current trends in establishing such courses. With the use of the general education programs in our colleges these courses are now becoming a very important part of modern curricula.

Two years later Eells[1] made a study of two hundred seventy-nine junior colleges and his findings concerning the science curriculum were very similar to those of Gray and Koos. The same courses were being offered and constituted fourteen per cent of the whole curriculum. These figures show the science curriculum during this period was very stable as to content and purpose.

In the next few years this situation changed very little and few studies were done concerning the curriculum in science. It was not until 1938 that the next study to be considered was published.

In this year, Colvert[2] conducted a survey of the junior college science offerings using approximately two hundred colleges as a sample to determine the science curriculum. The following table presents his findings.

1/ Walter C. Eells. The Junior College, Houghton Mifflin Co., New York, 1931.

2/ Clyde C. Colvert. The Public Junior College Curriculum, Louisiana State University Press, University of Louisiana, 1939.

TABLE 3

Science Offerings in Selected Junior Colleges

Course	Number of Colleges Offering the Course	Per Cent of Total*	Semester Hours Credit
Biology			
Zoology	128	76	6
Botany	118	70	6
General	65	39	6
Hygiene	39	23	3
Bacteriology	36	21	4
Anatomy	28	17	3
Survey Course	18	11	5
Microscopic Technique	8	5	2
Chemistry			
General	192	100	10
Organic	116	60	6
Quantitative	82	43	5
Qualitative	73	38	4
Physics			
General	127	90	10
Physical Science Survey	24	17	3
Electricity	13	9	5
Mechanics	12	8	3

*This figure is found by dividing the number of schools offering each course by the number of schools offering each field of science.

Colvert's study showed little had changed since the previous studies with the exception of the increase in offerings of the science survey courses and also the appearance of more specialized courses such as microscopic technique. The note under the table explains why the percentages are higher than in the other studies as they represent the percentage offering of each course relative to the number of schools offering each branch of science not relative to the total curricula offerings of the colleges surveyed. This study also showed that the number of offerings of the

courses increased with the size of the college as demand for them would naturally be greater with larger enrollments.

The next year Rennick's[1] work was published and indicated little variance from Colvert's findings with the exception of an almost twofold increase in the number of schools offering a physical science course. No laboratory was being offered with this new type course, a condition still prevalent with current physical science courses.

With these studies as a background the main part of this thesis will be presented now. The fact that almost ten years have passed since the last mentioned study should be remembered when reading this part of the study. During this period science has made tremendous technical and theoretical progress. We shall now see if a particular branch of science education, the junior college, has kept up with that progress by adding new courses to its science curriculum or by keeping up with new trends in education as a whole. This is the work of the following chapters where the findings of the present study will be presented and related to the studies discussed in this chapter.

1/ Howard Rennick. Survey of Chemistry and Physics Courses, Junior College Journal, Vol. 10, March 1940, pp. 394-395.

CHAPTER III

PRESENTATION OF DATA

Introduction

In the previous chapter research relevant to the problem in hand was discussed. In this chapter all data obtained by the author of this study will be presented. Each major branch of science surveyed will be considered separately, comparing present and past findings concerning the science curriculum and its purpose with special consideration being given to new trends in science curricula and their degree of adaptation by junior colleges.

Before discussing the content of these curricula it is necessary first to mention the accepted purposes of the junior college curriculum. As the science courses are a part of the total curriculum, consideration of the purposes of the latter can be directly transferred to the particular area of science. This study intends to discover just what purpose the science curriculum in the junior college serves and thus the need for discussing the aims of the total curriculum.

We shall be concerned with three major functions of a curriculum. They are the preparatory, terminal, and vocational functions. A preparatory course is one that is introductory in nature and prepares the student for further work in the same subject or field. It implies further work beyond the junior college level. A terminal course is one that implies no further study in the subject

nor does it necessarily prepare the pupil for life-time work. Such courses serve to enrich the general education of the pupil while not being of too much utilitarian value. The vocational courses prepare the pupil to participate directly in some vocational or semi-professional activity without further study. These courses are highly useful in nature.

In previous studies, Koos[1] and Proctor[2] found that the majority of junior college courses are preparatory. These courses are very similar to courses offered in the first two years of four-year colleges. The latter serve almost entirely in preparing the student for advanced work in the last two years of college. The junior college courses, according to these writers, are constructed so as to be acceptable for transfer to four-year colleges, making these courses preparatory in nature and purpose.

In planning an ideal junior college curriculum Conroe[3] presented courses that would also serve a preparatory function. Even courses that might be terminal in nature should also be preparatory so that they could be used as transfer credits if the students should desire to continue their education. All science courses included in such a curriculum must also be preparatory. They, along with other fields, must serve the purpose of a general education or a cultural education and not be specialized. Science courses were

1/ Leonard V. Koos. The Junior College, University of Minnesota, Minneapolis, Minnesota, 1924, 647 pp.
2/ William M. Proctor. The Junior College, Stanford University Press, California, 1927.
3/ Irwin A. Conroe. An Ideal Junior College Curriculum, Junior College Journal, Vol. 6, May 1936, pp. 384-391.

to be exploratory, not professional. Such a curriculum, then, is preparatory in purpose.

Many writers consider that the preparatory function is emphasized too strongly as evidenced by the following statement of Campbell[1], "From its inception the junior college has been purposed as an institution designed to achieve certain broad social ends of which preparation for further scholarly pursuits is but a part". Colvert[2] has stated that the great majority of leaders in the junior college movement believe that far more emphasis should be placed on terminal offerings and also vocational courses should be offered to a greater extent so as to meet the needs of our communities. Too many courses are preparatory in nature which should not be the case. The other two functions are too important to be neglected to the extent that they are now.

The National Society for the Study of Education[3] has found that the trend today is towards offering more courses that are terminal or occupational. Also, there is a trend towards offering survey courses which are part of the new idea of general education.

With the foregoing as a basis for understanding the functions of the science curriculum, the situation as it exists in junior colleges today will now be presented and discussed. This

1/ Doak S. Campbell. Necessity for Critical Evaluation and Appraisal, Junior College Journal, Vol. 6, December 1935, p. 109.
2/ Clyde C. Colvert. Curriculum Trends in Junior Colleges, Junior College Journal, Vol. 9, October 1938, pp. 13-17.
3/ Forty-Sixth Yearbook, National Society for the Study of Education, Science Education in American Schools, University of Chicago Press, Chicago 37, Illinois, 1947, pp. 222-224.

study will determine whether or not the function of the science curriculum has changed and also whether or not the newer trends in education are being adapted to the science curriculum in the junior college. If they are the extent to which such ideas are being followed will also be determined. Many of the studies presented above were written before World War II. Since then great advances have been made in science and these have affected our philosophy of life to an immeasurable extent. Now we shall see if the science curriculum has been modified by these advances or by new methods of teaching formulated since these studies were written.

Biology

This section will present the data obtained relative only to courses offered in the field of biology. The data is presented in the following tables.

TABLE 4

Biology Offerings in the Junior Colleges of New England*

Course	Number of Schools Offering the Course	Per Cent of Schools Offering the Course	Per Cent of Students Enrolled in the Course
Anatomy	11	48	2.3
General	10	43	6.0
Zoology	10	43	7.4
Botany	7	30	5.4
Bacteriology	6	26	1.6
Physiology	4	17	.79
Genetics	3	13	.60
Medical Lab Technique	3	13	1.3
Clinical Methods	2	9	.45
Histology	2	9	.30
Biological Sciences	1	4	.1
Comparative Vertebrates	1	4	.73
Hematology	1	4	.1
Health Education	1	4	4.4
Hygiene	1	4	1.7
Microtechnique	1	4	.1
Radiology	1	4	.58
Urinalysis	1	4	.1

*Constructed from the questionnaire used to gather facts for this study.

The table shows that although many biology courses are offered in the junior college, very few colleges offer more than one or two courses. The majority of the courses are offered by almost fifteen per cent of the colleges studied, a very low percentage. The most popular courses, anatomy, general biology, and zoology, are offered by only one-half of the schools. No single course is offered by all the colleges. Some colleges offered no biology courses at all in their curriculum while one school offered eight biology courses.

It can be seen that biology is not a field in which junior college students can major in the great majority of the schools. The most popular courses, those being offered the most often, are introductory courses so can serve the preparatory or terminal functions.

In order to see the value of biology courses in relation to the total junior college curriculum, the semester hours credit of each biology course will be presented now.

TABLE 5

Semester Hours Credit Given in Biology Courses in Junior Colleges*

Course	Number of Schools Offering the Course	Number of Schools Offering Laboratory	Average Semester Hours Credit	Range
Anatomy	11	11	6	3-10
General	10	8	4.5	3- 8
Zoology	10	10	5	3- 8
Botany	7	7	4	3- 6
Bacteriology	6	6	4	3- 8
Physiology	4	4	3	2- 4
Genetics	3	2	6	3- 9
Medical Lab Technique	3	3	4	3- 6
Clinical Methods	2	2	5.5	3- 8
Histology	2	2	3.5	3- 4
Biological Sciences	1			
Comparative Vertebrates	1	1	6	6
Hematology	1	1	6	6
Health Education	1			
Hygiene	1			
Microtechnique	1	1	3	3
Radiology	1	1	4	4

*Constructed from the author's questionnaire.

One interesting point that the table brings out is that practically every biology course offered has a laboratory offered in

conjunction with it. The only exceptions are those courses that are very general in nature which can serve to fulfill a science course requirement if the school has such a requirement as part of its total curriculum.

Comparing these two tables with those presented in Chapter II it can be readily seen that the junior colleges of today have a much larger selection of biology courses than were offered prior to 1938. The number of different courses offered today more than doubles the number offered in 1938 or 1924 as determined by Colvert and Koos respectively. With this increase in the number of biology courses offered has come a decline in the per cent of colleges offering any one particular course. In Koos' study botany was the course offered by the largest number of colleges with fifty-seven per cent of all the schools studied offering it. Zoology was the next most popular with fifty-two per cent of the colleges offering it.

In Colvert's study these two courses shifted places with regard to the one being offered most. Zoology was offered by seventy-six per cent and botany by seventy per cent of the colleges studied. The courses being offered the most today are anatomy, general biology, and zoology. Anatomy is offered by forty-eight per cent of the colleges studied while general biology and zoology are offered by forty-three per cent.

These figures show that, though more biology courses are being offered, fewer schools are offering one particular course as often as was the case previous to 1938. This study also shows that

less than ten per cent of the students enrolled in junior colleges are taking biology courses. Many courses are being taken by less than one per cent of the students. In most cases such courses are more specialized than the others offered. General or introductory courses are the most popular as far as student enrollment is concerned.

One important fact to be gained from studying these tables is the rising importance of the general biology course. In Koos' study it is found in fifth place with only sixteen per cent of the colleges offering it. Today it is found in second place with forty-three per cent of the colleges offering it. This course can serve only preparatory or terminal functions and indicates a swing towards the acceptance of a general biology course or a biological survey course in the curriculum of today.

Further comparison between the tables shows that the semester hours credit given to the courses in biology has varied little since the earlier studies. This can be accounted for by the fact that the junior colleges of today have the same total semester hour requirements for completion of the course of study as did the colleges in the past few decades. Approximately sixty hours are required for earning a diploma now as was the case then. The range of credit hours given for biology courses is presented in the tables to show that credit is not awarded uniformly in all junior colleges and also to show that there is no extreme variance in the credit given to any one course.

From the list of courses offered it can be seen that it is possible for a student to major in biology. However, only about ten per cent of the colleges studied offered enough biology courses to enable a student to major in biology. The fact that ninety per cent do not rules out the possibility of these courses being vocational in nature. In order to enter a semi-profession as biological work would dictate the student would need to study more biology and that means he would have to continue his study outside of the junior college. These courses then are either terminal or preparatory in nature.

The majority of the biology courses being offered are specialized, that is, they go beyond a study of general biology. These courses serve the purpose of preparing the student for advanced work in biology or related sciences. Therefore, they are preparatory as there would be little point in taking them to serve the terminal function. The introductory courses would serve this function to a far greater extent. Since they are the courses being offered most frequently the terminal function cannot be ruled out of importance. Biology courses, then, serve either the preparatory or terminal function. The instructors contacted in this present study also indicated this fact through the questionnaire which they completed and which served to gather the data presented in this study.

No new significant trends were discovered in relation to the offerings in biology. The following courses have been added since World War II by a few of the junior colleges surveyed:

clinical methods, genetics, general biology, physiology, comparative anatomy, and comparative vertebrates. In looking over these additions it is observed that no radically new course has been added to the curriculum of any one school. All the courses had been offered previous to the war in some of the colleges surveyed. Only one college offers a course in biological sciences, a survey type course, the offering of which in the junior college is advocated by many leading educators, as is reported in the Forty-Sixth Yearbook of the National Society for the Study of Education. The importance of such a course in our present-day educational system will be more thoroughly studied when the place of survey courses in the junior college and in other institutions of higher learning is taken up in a later section of this chapter.

Chemistry

The next major division of the science curriculum to be studied is chemistry. All data relative to chemistry offerings was gathered in the same manner as was the information about biology courses so it will be presented in a similar manner. The following table will list the information collected concerning chemistry.

TABLE 6

Chemistry Offerings in Selected Junior Colleges*

Course	Number of Schools Offering the Course	Per Cent of Schools Offering the Course	Per Cent of Students Enrolled in the Course
General	18	78	10.6
Organic	9	39	2.9
Quantitative Analysis	9	39	2.0
Qualitative Analysis	6	26	1.2
Inorganic	5	22	1.2
Biochemistry	1	4	.3
Physiological Chemistry	1	4	.1
Rubber and Plastics	1	4	.1

*Constructed from the author's questionnaire.

A comparison of this table with those listing the chemistry offerings as shown by previous studies indicates that the content of the curriculum in chemistry has remained fairly constant over the past few decades. This present study lists only eight different chemistry courses as being offered by the colleges surveyed. The basic content of the chemistry curriculum in past years consisted of the following courses: general chemistry, organic, quantitative analysis, qualitative analysis, and inorganic chemistry. Two of the previous studies did not list inorganic as being offered, perhaps because of the fact that inorganic and general chemistry are often combined in one course and are not offered separately.

The inclusion in this table of courses in biochemistry and physiological chemistry is evidence of the increasing trend to combine the various branches of science and not to teach them as separate entities. These two courses can serve as part of a pre-medical

Table 3

Modeling difference in [illegible] ranges in [illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible] [illegible] [illegible] [

program or preparation for further work in biology or biochemistry, a function not served by the chemistry curriculum prior to the present study.

The other newer course in chemistry, the course given in rubber and plastics, is also proof of the practice of offering courses that can be used in vocations. This is a practical chemistry course indicative of the direction many leaders of the junior college movement desire curriculum revision to follow. Baughman's[1] article on the pre-course in chemistry for nurses given at the Los Angeles City College is further indication that the junior colleges are increasingly turning towards the offering of practical courses in chemistry that will be of immediate use in vocational work.

Before further considering the purpose of the chemistry curriculum of today we shall list the credit given chemistry courses in order to form a basis for such a consideration.

1/ I. P. Baughman. Chemistry at Los Angeles City College, Junior College Journal, Vol. 12, February 1942, pp. 331-333.

TABLE 7

Semester Hour Credits Given for Chemistry Courses Offered in Selected Junior Colleges*

Course	Number of Schools Offering the Course	Number of Schools Offering Laboratory	Average Semester Hours Credit	Range
General	18	17	5.5	3- 8
Organic	9	8	5.6	5-12
Quantitative Analysis	9	9	4	3- 4
Qualitative Analysis	6	6	4.5	3- 8
Inorganic	5	4	7	5- 9
Biochemistry	1	1	4	4
Physiological Chemistry	1	1	3	3
Rubber and Plastics	1	1	5	5

*Constructed from the author's questionnaire.

The credit assigned to chemistry courses has varied very little throughout all the studies conducted, including this present one. The reasons for this fact are the same as was explained in the consideration of the credits awarded biology courses. Laboratory offerings are indicated in order to show why science courses are given more credit than other courses in the total curriculum. As practically every school offers a laboratory with every science course the average credits of all science courses are equal to or above those given to non-science courses. The range of credits awarded for any one science course also proves this fact to be true.

As was the case in studying the biology curriculum, very few junior colleges offer enough chemistry courses to allow a student to major in chemistry. Less than twenty per cent of the schools

studied offer a sufficient number of courses to constitute a major in chemistry. Only one school offered a course suitable for direct vocational use, indicating again that the great majority of courses are either terminal or preparatory.

By studying the chemistry offerings it can be seen that both of these latter functions are important and in common use. The majority of the chemistry courses offered are beyond the introductory level so would serve the preparatory function almost entirely. Courses such as quantitative analysis, organic chemistry, and biochemistry have little value as terminal offerings, nor are they sufficient to constitute sole use in the semi-professions, especially as few schools offer more than one or two of these courses during the two-year program. Such courses, then, can be placed under the preparatory function almost without exception.

Such is not the case with the course in general chemistry. This course must be considered separately because it is the chemistry course offered by more colleges than any other course. This has been shown in all the studies mentioned. It is also the one science course offered by schools more than any other course in science. This study also shows this course to be the most popular course as far as student enrollment is concerned. It is the course most often taken to meet a science requirement, if the college has such a requirement. This course, then, can serve the terminal function as well as the preparatory, and since it is the course offered the most and has the largest percentage of enrollment the

terminal function cannot be ruled out of importance. Chemistry courses, then, as was the case with biology, serve either the terminal or preparatory function in the great majority of cases.

New additions to the chemistry curriculum in a few of the colleges studied include the following courses: organic chemistry, physiological chemistry, and quantitative analysis. These courses are not courses that were not offered before the war, indicating that, with the exception of the two courses already discussed, no new trends are being followed or set in the field of chemistry. The traditional curriculum is still adhered to by most junior colleges. The fact that these courses are mostly preparatory dictates such a course of action. With the increasing practice of making all science courses more practical, especially the introductory courses, perhaps this situation may change. Subsequent studies will show whether or not this is to be the case. The time element may not have been great enough for this study to show the effect of trends produced by the recent war in revision of the chemistry curriculum.

Physics

The next general branch of science to be considered is that of physics. The same scheme as was followed in discussing biology and chemistry will be adhered to in studying the place of physics in the curriculum of the junior college.

TABLE 8

Physics Offerings in Selected Junior Colleges*

Course	Number of Schools Offering the Course	Per Cent of Schools Offering the Course	Per Cent of Students Enrolled in the Course
General	13	56	6.8
Mechanics	2	8	1.2
Electricity	1	4	1.2
Aeronautics	1	4	.2
Thermodynamics	1	4	.1
Communications	1	4	.1

*Constructed from the author's questionnaire.

The total number of different physics courses offered is the lowest of all the branches of science included in this study. This study shows only six different courses are being offered by the colleges surveyed. The previous studies included only the first three listed in the above table, with all three usually being on the introductory level.

The only course being offered by any number of colleges is the general physics course. Whitney's study showed only thirty-two per cent of the junior colleges to be offering this course, while Koos' study listed forty-three per cent of the colleges he surveyed as offering the course. This study lists fifty-six per cent of the schools studied as offering the course, indicating a rise in popularity of the course.

In direct contradiction to this increase is the decrease in the per cent of schools offering mechanics and electricity. Fewer colleges are offering these two courses today than in previous years, a surprising condition when the rising importance of physics is

considered.

In order to complete the data necessary to determine the purpose of the physics curriculum the credit hours of these various physics courses will be listed in the following table.

TABLE 9

Semester Hours Credit of Physics Courses

Offered in Selected Junior Colleges*

Course	Number of Schools Offering the Course	Number of Schools Offering Laboratory	Average Semester Hours Credit	Range
General	13	12	6	3-8
Mechanics	2	1	5	5
Electricity	1	1	5	5
Aeronautics	1		6	6
Thermodynamics	1	1	5	5
Communications	1			

*Constructed from the author's questionnaire.

The average credit given the physics courses has also been found to have been comparatively stable over the past few decades, as determined by the studies concerning the junior college science curriculum.

These two tables show that in all cases but one students cannot major in physics in the junior college. One junior college included in this survey offered ten courses in electricity so that a student in this school could major in electricity, but since this is an exceptional case it does not alter the conclusions to be drawn from the data collected.

The last three courses listed, aeronautics, thermodynamics, and communications, are specialized courses but have little direct

use in vocational work as only thermodynamics offers the laboratory essential for preparation in such courses to enable use in vocations without further work in the same area of physics. These courses are also of little value when offered as terminal courses because of their specialized character. They must then be largely preparatory. The same may be said of the courses in mechanics and electricity.

General physics can once more prove an exception to this statement. It is the course offered by most schools today, as well as in the past, and also the enrollment in this one course exceeds the enrollment in all the other physics courses combined. General physics can be used as either an introduction to the total area of physics, if one plans to continue in the field, or it can serve as a terminal course used to satisfy various needs of students, needs dictating the course to be of terminal nature as far as these students are concerned.

One fact to be noticed is that no courses dealing with nuclear physics are included in the curriculum of any junior college surveyed. Such a course is given by many four-year colleges and students in the two lowest classes can take such courses after having an introductory course in physics. Yet no college surveyed offers such a course. This indicates that junior colleges are lagging behind regular colleges in keeping pace with modern advances in science, a fault very prevalent in all education of today.

Since the war, the following courses have been added by a few junior colleges: communications, electronics, and radio. These

additions are evidence that there are some schools that are making their physics offerings more practical and less conforming to the traditional make-up of a physics curriculum. These courses can be used directly in vocational applications, further indication of this trend. The physics curriculum prior to the war consisted of courses that had very little vocational application, a condition that is rapidly changing today.

The course offered in physical science has not been discussed in this section but has been left to the next where it will be discussed under survey courses. Because of the growing importance of such courses a separate section will be devoted to consideration of them.

Integrated Sciences

This section will be concerned with a discussion of the newer type physical and biological science courses. It has not been entitled "Survey of Science Courses" because such a title is misleading. Most of the courses included in this section are not survey courses, nor are they meant to be. These courses are a part of the general education programs now being adopted by so many colleges and they constitute an attempt to make the study of science more practical, that is, more applicable to every day living. They are not an attempt to give every student a smattering of science merely to fulfill a college requirement in science or vaguely acquaint the student with science. This must be remembered while studying the

content and purpose of these integrated science programs.

The following table will present data concerning such science courses now being offered in the junior college. These courses will then be compared with those described by the authors of the studies previously mentioned and also with the type of course recommended by leading educators.

TABLE 10

The Physical Science Course in the Junior College*

Number of Schools Offering the Course	Per Cent of Schools Offering the Course	Number of Schools Offering Laboratory	Average Semester Hours Credit
7	30	2	4.5

*Constructed from the author's questionnaire.

Gray[1], in his study conducted in 1929, found that in the schools surveyed twenty per cent of them offered an integrated science course in the freshman year or the first year of the junior college. In 1940, Rennick[2] conducted a similar study and found eighteen per cent of the junior colleges to be offering such a course. No laboratory was given as part of the course.

This present study shows that thirty per cent of the schools surveyed are now offering a physical science course, a considerable increase and one that has occurred in the past few years. Two of the schools having such a course offered a laboratory in

1/ William S. Gray. The Junior College Curriculum, University of Chicago Press, Chicago, Illinois, 1929, 261 pp.
2/ Howard Rennick. Survey of Chemistry and Physics Courses, Junior College Journal, Vol. 10, March 1940, pp. 394-395.

conjunction with it but the majority of schools still do not offer laboratory work with their physical science course. The "Report of the Research Committee on Junior College Science" indicates that thirty-five per cent of the schools surveyed offered an integrated science course with the majority being physical science courses with no laboratory offering. They also reported that many schools are working on curriculum revision, the inclusion of a physical science course in their curriculum being part of that work. This present study found that two of the colleges surveyed had accomplished this work in the past two years.

This emphasis on these newer type courses, perhaps, needs further explanation. The trend in junior colleges and the lower two grades of a four-year college is towards a curriculum designed to present the student with a general education as is reported by the National Society for the Study of Education.[1/] This means postponing the teaching of specialized courses, including sciences, until grades fifteen and sixteen. Instead, the student should be taught to comprehend the significance of science and its practical aspects. A course built around these objectives is now being taught at Chicago City Junior College.[2/] This course attempts to integrate the sciences with all other fields of instruction. No laboratory is

1/ Forty-Sixth Yearbook, National Society for the Study of Education. Science Education in American Schools, University of Chicago Press, Chicago, Illinois, 1947, Op.Cit.

2/ Glen W. Warner and James B. Parsons. Post-War Physical Science, Chicago School Journal, Vol. 27, January 1946, pp. 73-76.

now offered but it is considered an advantage if one can be offered along with such a course.

The integrated science courses reported in this study consist of both biological sciences and physical science. Only two junior colleges offered a course in biological science. This course was an integration of the general biology, bacteriology, and physiology courses taught in a traditional biology curriculum. Further integration with the total college curriculum was also an objective of this course.

The physical science courses reported were more varied, encompassing a larger number of courses within the general area of the physical sciences. This type course in practically all cases consisted of an integration of the following courses: chemistry, physics, astronomy, geology, and meteorology. One course also included a study of physiography. The objective of these fused courses was to teach the student the interdependence of the sciences and also the practical value of science, even to students who had no idea of doing further work in any scientific area. Such a course designs to teach all the scientific method and its applications to general living, not merely its applications within the fields of science.

A good example of an integrated science course is the one being offered at the Boston University General College[1], a two-year

1/ Wesley N. Tiffney. The Science Program in the Boston University General College, W. C. Brown Co., Dubuque, Iowa.

school on the junior college level. This school requires all students to take this fused science course during both years of matriculation in order to assure all a thorough general education in science as well as the humanities.

The course integrates physics, chemistry, biology, geology, and astronomy, not only amongst themselves, but also with all other courses in the curriculum. The achievements of the principal sciences are presented to show how science affects culture and growth. Relationships, not facts, are stressed, yet the course remains thorough in its treatment of the sciences involved. The sciences are not treated separately. All courses within the curriculum are fused so that the scientific, political, social, and economic aspect of any phenomenon are presented together enabling more complete understanding of the topic being studied as well as more meaningful understanding. Relating science to culture makes it easier to comprehend and also more useful for the student who does not purpose to go further into scientific study.

Those who wish to make science their life work are not handicapped in such a course as they receive credit for six hours in biology, six hours in physics, and three hours in geology after completion of the two-year program. Chemistry credit may be awarded in the future if the school can work out a system of awarding such credit satisfactory to itself and the American Chemical Society. These students can transfer to other colleges and continue their work in science with a sound basis in introductory sciences. Trans-

fer before they complete their two years at this school is possible also. Although a small minority of the total student enrollment, these students are not handicapped by matriculating in this school, while the non-science students, constituting a great majority in the school, receive a training in science that for them is practical and useful.

A similar course is being given at Northwestern.[1] While this is not a junior college, the course is given in the freshman year so serves as a very good example of the newer type course in integrated science that is used in both junior and senior colleges. This course is built around both physical and biological science and a laboratory is given along with the subject matter.

This course is divided into topics which are considered from an integrated viewpoint of all the sciences. No rigid categories of science are presented, but a unified whole is the aim of this course. Each topic is related with others considered so that the interrelationships in science can be observed and studied.

The course is designed for students who are non-science majors but who need a study of science for a well-rounded general education. They are taught applications of the scientific method in all fields of learning, an endeavor in itself that makes the course worthwhile for all students. The students are given an excellent foundation in science that can serve either as general

1/ N. E. Bingham. Introduction to Science, Science Education, Vol. 32, December 1948.

education or as a basis for further work in science, if such a desire should be developed by this course. Interest in science is furthered by the course. It is not neglected or destroyed.

The laboratory given with this course is also worthy of mention as few courses in integrated science offer such work. Experiments are done that use and develop knowledge in all sciences, not in one or two branches. They serve to further integrate the sciences. Such laboratory work is hard to prepare but this course is a good example of an attempt to give the students a working knowledge of science and not merely a summation of theory gained from the study of subject matter as presented in textbooks.

Courses in the integrated sciences can easily be seen to be of little direct vocational use. These courses are designed to give the student a general education as part of a literal arts program. They are not intended for vocational use. Their primary function is as a terminal offering. The majority of students taking such a course do not intend further work in science. This is the one science course, then, that is almost entirely terminal. The fact that it can be used as preparation for further work in science makes the preparatory function a possibility.

The importance of the course lies in the fact that it is designed primarily as a part of the general education program of any junior college. With Federal aid to education a likely probability the importance of the junior college will increase and with it the necessity for a course in the integrated sciences. That is why

this complete section has been concerned solely with a discussion of this area of the junior college science curriculum.

The Sciences Collectively

Each of the individual areas of science with which this study is concerned have been discussed separately and conclusions have been drawn that in the main apply to the one branch of science under which they are mentioned. This was done to show the content and purpose of each area of science. Now the purpose of the complete science curriculum will be discussed, the content, of course, remaining unchanged.

It has been shown that in the great majority of the schools studied a student cannot major in just one branch of science. Less than ten per cent of the schools offered a sufficient number of courses in biology to enable a student to major in this science. Although the total range of courses offered was large, very few schools offered more than two or three courses in biology. The same situation exists in the case of the curriculum in chemistry or physics. Integrated science courses are excluded from this part of the study as they are not intended as a separate science program that students may major in.

In order to major in a specific field in a junior college a student needs twenty or more semester hours in this field. This is not possible as we have seen in any specific branch of science. That would mean taking, on the average, five or more courses in

the specific science. As can easily be seen, it is possible to major in science as a whole. That is, by taking courses in all the sciences or any combination of them a student can gain a sufficient number of semester hour credits to meet the requirements necessary to constitute a major.

Since the possibility exists that a student can major in science in the junior college the actual situation, as it is found in the junior colleges surveyed, will now be studied. Practically every college surveyed offered enough courses in all the sciences to enable a major in science, but only thirty per cent of these colleges will allow a student to major in science. The majority, then, do not offer their science program as a major. Restrictions are placed on the number of science courses a student may take during his two years of college.

The colleges surveyed reported that the maximum number of science courses a student could take varied all the way from one course to twelve courses. Twenty-nine per cent of the colleges restricted the number of science courses that could be taken to two courses, nineteen per cent restricted the number to three, nine per cent to four, and nine per cent to one. The rest permitted a student to take five or more science courses. In two-thirds of the colleges surveyed students cannot take enough courses to allow them to major in science. The other one-third does allow its students to be science majors.

These figures then indicate that the science program in

the junior college is a terminal program for the majority of the students. The program has been shown to be very little concerned with the vocational function of a curriculum. It then purposes to serve either the preparatory or the terminal function. The fact that the introductory courses are the most popular and that most schools do not allow majors in science gives strong support to the idea that the science courses in the junior college are becoming more terminal. Further reasons for their becoming so is that eighty per cent of the junior colleges require students to take at least one course in a science. Naturally, these students will take introductory courses as the majority of them are non-science majors. This requirement greatly increases the terminal function of science courses. These students will probably never take further science courses. The study of science, then, for them is completed with this one course in science. These courses are thus terminal courses.

This requirement also greatly increases the importance of an integrated science course. The science requirement is to give the students a broader general education. This is also the purpose of the integrated science courses, a purpose not yet realized to any extent by the junior colleges, as indicated by the relatively small percentage of such schools offering either a course in biological or a course in physical science.

The large number of specialized courses offered in science is strong proof that the preparatory function is still one

of the dictating factors in the construction of the science curriculum. These courses serve this function almost entirely, a situation that has existed throughout the history of the junior college, as this study has indicated. With the tremendous emphasis that is placed on college degrees today this situation will continue to exist. Two-year terminal education has not sufficient popularity today to displace the preparatory function of the curriculum in science. Therefore, both the terminal and the preparatory function remain as the major influences dictating the purpose of the science courses offered in the junior colleges surveyed in this study.

CHAPTER IV

SUMMARY - CONCLUSIONS - RECOMMENDATIONS

In the beginning of this study the problem of the content and purpose of the science curriculum in the junior college was presented. In the succeeding pages material followed that resulted in the presentation of the actual content of science courses in these schools as well as the purpose of these courses. It has been shown that the science curriculum is largely preparatory or terminal in nature as far as the majority of the students taking these courses are concerned. Allowing for the fact that many students take more than one course in science so that a duplication results when any percentages are computed which compare the science student population with the total college population, it has been shown that very few students take science courses. A far smaller number of students major in science in junior colleges.

The junior colleges do offer a wide range of courses in the areas of science studied. Eighteen courses in biology are offered by all the schools, which is indeed an impressive total offering for the first two years of college. Eight different courses are offered in chemistry and six different courses in physics. These are the combined offerings of all schools. Of course, no one school offers all of these science courses in its curriculum. A few schools do offer a sufficient number of courses to enable a student to get a training in science entirely comparable

to or even exceeding the training offered in most four-year colleges.

Biology courses offered the best opportunities for science students matriculating in junior colleges. They are by far the most numerous among the science offerings and can serve best the wide variety of interests likely to be found among students even in the same branch of science. In this field lies the best possibility for a student to secure a functional training in one particular area of science. Chemistry does not offer such an opportunity, yet opportunity for a working knowledge of chemistry to be gained in the junior college is not lacking. A sufficient number of courses is offered to fulfill the needs of most students who would wish either to begin preparation for a career in chemistry or who might wish to gain a training adequate in preparation to enable them to find immediate vocational placement upon completion of the two years' work.

Such is not the case in the area of physics. The very great majority of the colleges do not offer enough physics courses to enable the student to prepare himself for immediate vocational application of his training. Physics is the least popular of the areas of science, both in courses offered and in students enrolled. Such seems to be the case in the majority of colleges in this country. Very few junior colleges offer more than a general course in physics, making vocational use of this area of science an impossibility as far as the junior college training is concerned. This seems a paradox considering the tremendous advances made in

the different areas of physics as evidenced by the work in nuclear physics and aeronautics in the past decade. This work has affected the courses of study in the junior college to a negligible extent otherwise curriculum changes in physics would have resulted. This study has shown that such is not the case. Few, indeed, have been the changes in the composition of the physics curriculum in our junior colleges. This area of science is serving the same functions that it has for many years. Physics has progressed but physics teaching in the junior college has remained almost completely stationary.

In the area of integrated science courses we can expect no vocational training. These courses are designed almost entirely to be terminal. This study has shown that the majority of students in the junior college are non-science majors, yet they have to have some training in science in most cases. Science still is an important part of a good general education program. Today general education is one of the fastest growing movements in the field of education. This is true especially in the junior college or in grades thirteen and fourteen. The integrated science courses are the only science courses that are designed specifically to meet the aims of a general education program. In most cases they constitute an important area of such a program.

It has been repeatedly emphasized in this study that most junior college students are enrolled in science courses on a terminal basis. Yet, less than one-third of the junior colleges

offer their students a course in the integrated sciences although such a course fits their needs far more adequately than any other type of course. General education and the terminal function are requirements well met by these courses. They should necessitate such a course being offered in all junior colleges, but that is not the case as has been indicated. Some schools offer excellent courses in this division of science, but the number is too few. The junior college is the ideal grade placement for these courses. Here is, perhaps, the last opportunity for most students to gain a functional knowledge of the sciences as an integrated whole. These colleges are not meeting this demand satisfactorily, a demand made imperative by the role science plays in our culture of today. Meeting this demand could do much to alleviate many of the problems facing the world we live in.

From the foregoing facts enumerated it is seen that the junior colleges are not meeting some of the most pressing demands upon such schools, demands made on the sciences as a whole. The science curriculum in the junior colleges studied has remained almost stationary throughout the years. One of the major aims of this study has been to discover if this situation does exist and then to make recommendations to rectify it. It is beyond the scope of this work to plan out a science curriculum that would be more functional. This work is intended only to point out the fact that the curriculum does need revising so as to conform to modern methods and practices in education.

The vocational aspect of the sciences seems to be neglected to an extent that is almost incomprehensible. The courses in science can serve as training in semi-professional vocations but the schools studied do not design their courses to serve this purpose to any great degree. Years ago, Koos wished to revise the junior college curriculum to meet such needs, but it is evident that little work has been done along this line. A two-year training is sufficient for many jobs in the semi-professions and the junior colleges are the logical schools to offer this training. Yet, this study shows they have done little to make available such training to science students. The junior college science curriculum is still functioning as preparation for further training in science. The vocational function of the curriculum has not been developed to the extent that it should be. Not until such is done will the courses in science be made to serve the many functions to which they are suited.

With this study as a basis it is hoped that future science students will have more evidence from which to select the type of school they will choose for further work in science. Whether or not the junior colleges offer the courses desired by these students can be learned from this study thus making this work worthwhile. It has intended to point out just what courses are being offered and why, so enabling future students to better choose their field of science in which to work. The work has also pointed out the value of certain courses to the non-science majors to whom science can be

such a drudgery when actually it should be a challenge and an integral part of their total educational program, a part that should be meaningful. The new courses described in this study are a step in making science meaningful to these students and it is hoped that this and other works will stimulate the junior colleges in order that more courses of this nature will be included in their curriculum. If such is the case, the purpose of this study will have been served admirably and the work will help further the aims of modern education.

The junior college movement today is well established. The prospect is that it will increase in the future. The great demand for mass education dictates such a course of action. But with growth should come progress in the area of curriculum revision. There is much room in the fields of science for such revision as this study indicates. Opportunities for vocational training and general education abound in the advance secondary school. Until now, little has been done in the junior college to meet these challenges. Yet with so many traditions being shattered today there is much hope that the traditional curriculum in these schools will give way to one that is more functional and more worthwhile to the junior college students and to society as a whole.

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Recommendations for Further Study

1. A survey might be conducted that will determine the semi-professions for which the junior colleges can train students effectively.

2. Do public and private junior colleges serve the same functions with the same degree of emphasis upon any of these functions?

3. What are the reasons for the dearth of public junior colleges in New England?

4. What is the position of general education in the junior colleges today?

APPENDIX

BIBLIOGRAPHY

1. Baughman, I. P. Chemistry at Los Angeles City College, Junior College Journal, Vol. 12, February 1942, pp. 331-333.

2. Bingham, N. E. Introduction to Science, Science Education, Vol. 32, December 1948.

3. Colvert, C. C. Critical Analysis of the Public Junior College Curriculum, Louisiana State University Press, Baton Rouge, Louisiana, 1939.

4. ---------- Curriculum Trends in Junior Colleges, Junior College Journal, Vol. 9, October 1938, pp. 13-17.

5. Conroe, Irwin A. An Ideal Junior College Curriculum, Junior College Journal, May 1936, pp. 384-391.

6. Eells, Walter C. Bibliography on Junior Colleges, United States Office of Education Bulletin No. 31, 1930.

7. ---------- Present Status of Junior College Terminal Education, American Association of Junior Colleges, Washington, D. C., 1941.

8. ---------- The Junior College, Houghton Mifflin Company, Boston, 1931.

9. Forty-Sixth Yearbook, National Society for the Study of Education, Science Teaching In Junior Colleges, University of Chicago Press, Chicago, Illinois, 1947.

10. Gray, William. The Junior College Curriculum, University of Chicago Press, Chicago, Illinois, 1929.

11. Koos, Leonard V. The Junior College, University of Minnesota, Minneapolis, Minnesota, 1924.

12. ---------- The Junior College Movement, Guin and Company, Boston, 1925.

13. Noll, Victor H. Teaching Science in Elementary and Secondary Schools, Longman Green and Company, New York, 1939.

14. Powers, S. R. and Blick, D. J. Teaching Science in Senior High School and Junior Colleges, Review of Educational Research, Vol. 15, October 1945, pp. 301-309.

15. Proctor, William M. The Junior College, Its Organization and Administration, Stanford University Press, California, 1927.

16. Rennick, Howard. Survey of Chemistry and Physics Courses, Junior College Journal, March 1940, pp. 394-395.

17. Thompson, John F. Junior College Movement in New England, Master of Education Thesis, Boston University, Boston, Massachusetts, 1938.

18. Van de Bogart, G. H. Junior College Science Teachers, National Education Association, 1927, pp. 593-597.

19. Warner, G. W. and Parsons, J. B. Post-War Physical Sciences, Chicago School Journal, Vol. 27, January 1946, pp. 73-76.

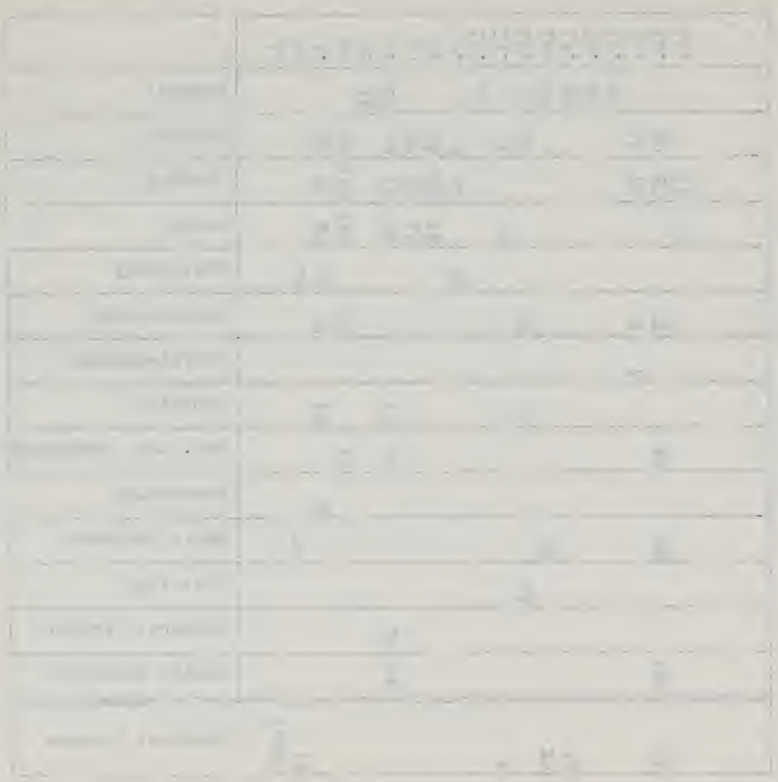
20. Whitney, Frederick L. The Junior College in America, Colorado State Teachers College, Greeley, Colorado, 1929.

GENERAL TABLES

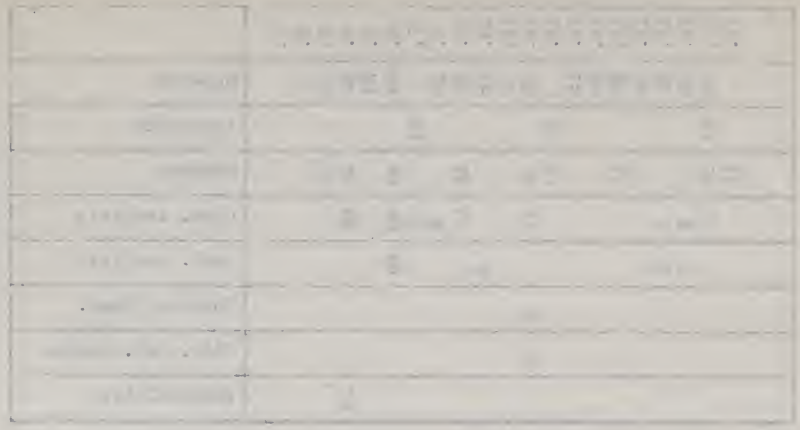
School	Type	Student Body	Hours Required for Graduation	Approximate Enrollment
1.	Private	Coed	64	1,200
2.	Private	Women	60	280
3.	Stockholders	Coed	58	125
4.	Private	Women	66	390
5.	Private	Coed	60	60
6.	Private	Coed	64	600
7.	Private	Women	64	110
8.	Private	Women	64	300
9.	Private	Women	60	500
10.	Public	Coed	60	90
11.	Private	Coed	60	30
12.	Private	Women	60	220
13.	Private	Coed	60	1,300
14.	Private	Women	60	280
15.	Private	Coed	60	200
16.	Private	Coed	60	125
17.	Private	Women	64	385
18.	Private	Coed	60	700
19.	Public	Coed	60	165
20.	Private	Men	60	185
21.	Private	Men	70	25
22.	Private	Men	60	120
23.	Public	Coed	60	350

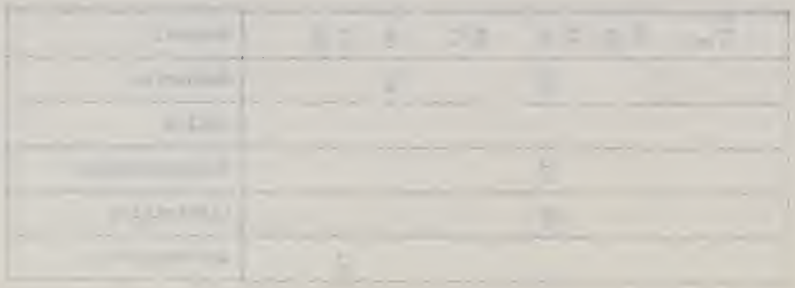
ENROLLMENTS IN INDIVIDUAL COURSES

Biology and Physical Science

	General	Anatomy	Zoology	Botany	Physiology	Bacteriology	Microtechnique	Genetics	Med. Lab. Technique	Hematology	Biol. Sciences	Histology	Compara. Verteb.	Health Education	Physical Science
1.															1,200
2.					15						75				75
3.		10	50	50	10	6		12		6					
4.		40	115	115		36			75						
5.	14														
6.	80	40	70	80				20	20				50	300	
7.		20	10	10											
8.		15	24	15											
9.		3	49		38										
10.	21														
11.		1		6											5
12.	50	30				25		10				15			
13.	20										25				25
14.	50														40
15.	60														
16.	23														
17.		10	50			7	7								
18.		30	60			35			35		25			120	25
19.			78	78											

ENROLLMENTS IN INDIVIDUAL COURSES IN CHEMISTRY AND PHYSICS

	Chemistry								Physics					
	General	Inorganic	Organic	Quan. Analysis	Qual. Analysis	Physical Chem.	Clin. Lab. Method	Biochemistry	General	Mechanics	Optics	Thermodynamics	Electricity	Aeronautics
1.														
2.	10													
3.	35		10						20					
4.	50		25	25				20	15					15
5.	30													
6.	240		50	40	60				100	30				
7.		20		6										
8.	20			5										
9.	40		18	18					17					
10.	25				8				20					
11.	5													
12.	45		6	12		6	6							
13.		10	30						50	50		10	80	
14.	15								12					
15.	30													
16.	60		15						35					
17.	80								68					
18.	30			3	3									
19.	40			5	5				8					
20.	35	40	35	12					5					
21.			12						117					





Bentley, Colin
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